



**TRAINING – AN IMPORTANT FACTOR IN REDUCING PREANALYTICAL ERRORS  
IN BIOCHEMISTRY LAB OF A TERTIARY CARE HOSPITAL**

**Gurpreet Singh Battu\*, Amitoj Singh Battu and Sumeet Sidhu**

Amar Hospital, ITO Road, Patiala, Punjab, India.

**\*Corresponding Author: Dr. Gurpreet Singh Battu**

Amar Hospital, ITO Road, Patiala, Punjab, India.

DOI: <https://doi.org/10.17605/OSF.IO/9WVUC>

Article Received on 13/12/2020

Article Revised on 03/01/2020

Article Accepted on 23/01/2021

**ABSTRACT**

Training plays an important role in reducing incidence of preanalytical errors in biochemistry lab. Preanalytical phase is most prone to errors due to various contributing factors. Human involvement is maximum in this phase and automation is almost negligible. Aim of this study was to find effect of training on the frequency of errors. Incidence of preanalytical errors was analysed for the period June – Nov 2019 as per predefined list of errors. All the staff involved in the process of sample collection was trained in the right techniques for a month. Again, the data was collected for the period Jan – July 2020. When compared to data of period before the training was imparted, there was statistically significant decrease in the incidence of errors in post training period.

**KEYWORDS:** Preanalytical phase, errors, biochemistry, training.

**INTRODUCTION**

Journey of a patient in a hospital, whether on OPD or IPD basis, is a leap of faith. Patients expect the doctors to make a correct diagnosis and treat the patients in a logical and judicious manner. Clinical acumen of clinicians is supported by diagnostic tests to reach a conclusion about the condition of the patient. Clinical lab helps in making diagnosis and evaluating progress of disease, thereby playing a significant role in course of treatment of patients. Total lab process can be divided into three phases – Preanalytical, Analytical and Post-analytical.<sup>[1]</sup> Out of these three phases, preanalytical phase is most prone to errors for various reasons.<sup>[2]</sup> These errors might have detrimental effect on the clinical outcome and contribute to increased cost and decreased level of faith on healthcare services.<sup>[3]</sup> When compared, IPD blood samples are found to have more errors than samples collected in OPD.<sup>[4]</sup> Various errors noted were samples that were unlabeled, clotted, diluted, hemolysed, insufficient quantity or wrong requisition slip.<sup>[5]</sup>

**Aim**

Samples from IPD have been found to have more errors for various reason, primary reason being different people involved in the process of sample collection. IPD samples are collected in different areas of the hospital by nursing staff or resident doctors. OPD samples are collected by the same team of laboratory technicians. It was decided to train all people involved in the process about right technique, vacutainers and steps. Aim of this study is to determine the effect of training on incidence

of preanalytical errors of biochemistry tests.

**MATERIAL AND METHODS**

Errors in preanalytical phase were defined as – incomplete/ error in requisition form, incomplete identification label on sample container, incorrect quantity of sample, hemolysed samples, wrong vacutainers or diluted samples.

Incidence of preanalytical phase errors was analysed for the period June to November 2019. The findings were discussed with the staff and all the staff involved in the process of sample collection were trained in right techniques.

Trainings were conducted in the month of December 2019. Senior lab technicians acted as trainers and department of quality with the help of management, organized the trainings.

Incidence of errors was again analysed as per data collected in the months of January to July 2020. The findings were statistically compared with numbers of pre training data.

**RESULTS**

Total number of samples collected in the period June to November 2019 were 60325. Out of these 40668 were IPD samples and 19657 were collected in OPD. (Figure 1.)

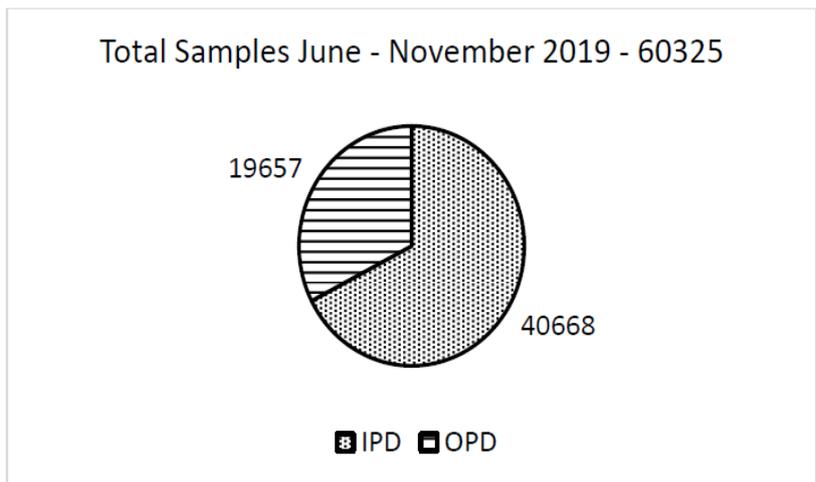


Figure 1.

Out of the total, 1307 (2.2%) samples were found to have one error or the other as per defined list of errors. (Figure 2.)

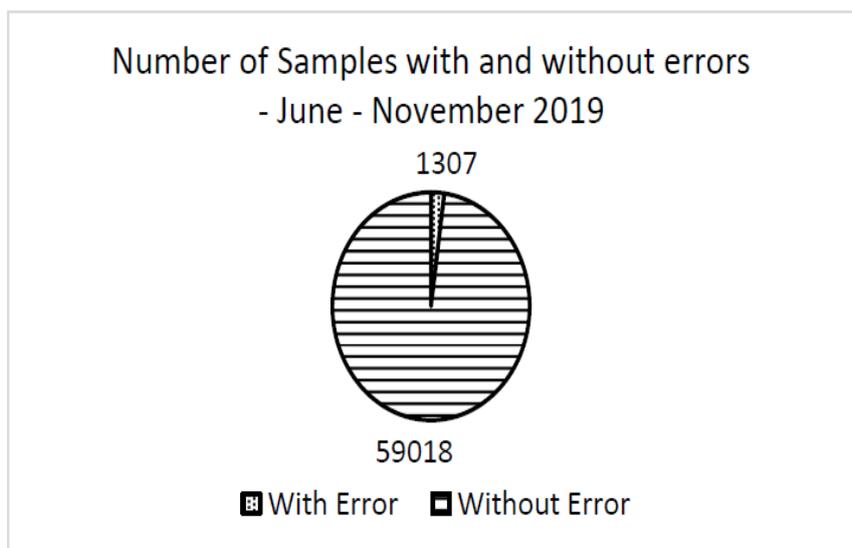


Figure 2.

Distribution of errors during this period was as per Table 1.

Table 1.

	2019	
	Number	% of Total Samples
Wrong vacutainer	68	0.1
Inadequate quantity	212	0.4
Incomplete label	286	0.5
Dilute samples	174	0.3
Heamolysis	102	0.2
Incomplete requisition form	465	0.8
Total	1307	2.2

Total number of samples collected in the period January to July 2020 were 67871. Out of these 41967 were OPD samples and 25904 were collected in IPD. (Figure 3.)

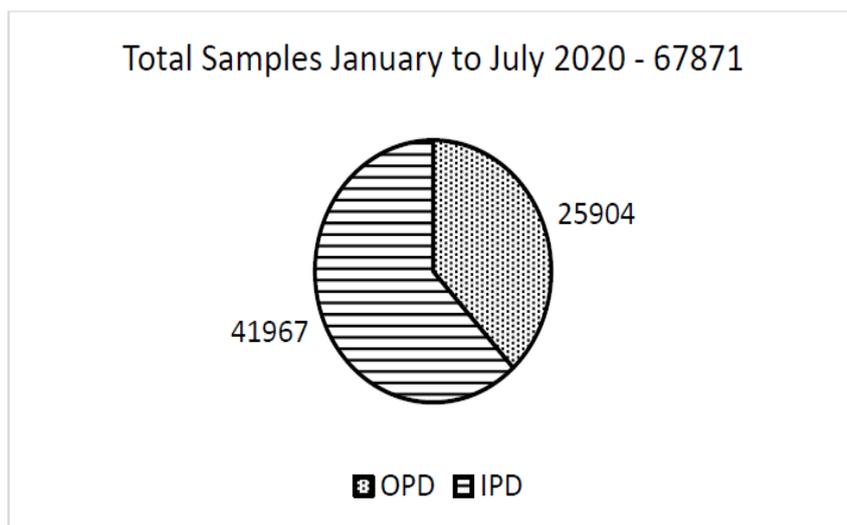
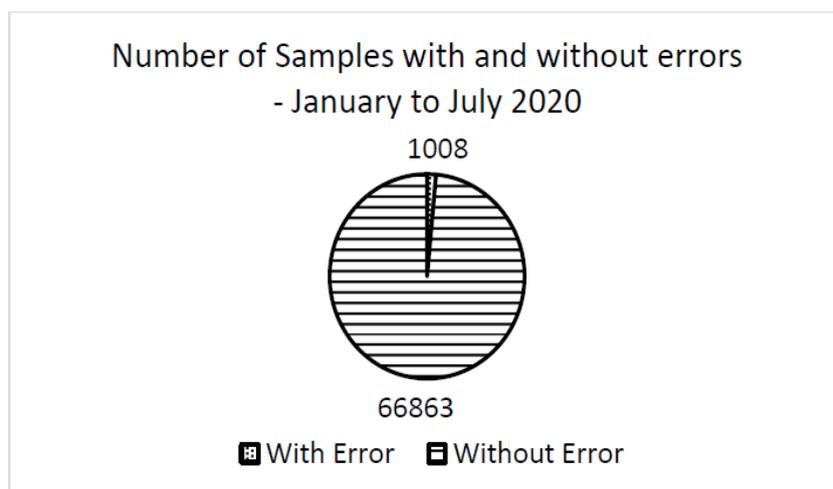


Figure 3.

Out of the total, 1008 (1.5%) samples were found to have one error or the other as per defined list of errors. Figure 4.



Distribution of errors during this period was as per Table 2.

Table 2.

	2019	
	Number	% of Total Samples
Wrong vacutainer	51	0.1
Inadequate quantity	162	0.2
Incomplete label	220	0.3
Dilute samples	133	0.2
Heamolysis	78	0.1
Incomplete requisition form	364	0.5
<b>Total</b>	<b>1008</b>	<b>1.5</b>

Number of errors for pre training time period (June – November 2019) were statistically compared with number of errors in post training period (Jan – July 2020), using Chi Square method.

	Number of Samples	Number of Errors
June to November 2019	60325	1307
January to July 2020	67871	1008

The chi-square statistic is 80.6363. The p-value is < 0.00001. Significant at p < .05.

The chi-square statistic with Yates correction is 80.2595. The p-value is < 0.00001. Significant at p < .05

Number of errors decreased after the staff were trained in sampling techniques. Difference between number of errors between two groups was statistically highly significant.

## DISCUSSION

It has been well established that frequency of preanalytical errors in a biochemistry lab is more in IPD setting as compared to OPD collection center. These errors can be significantly reduced by training the involved staff in right techniques of sample collection.

Chavan PD, Bhat VG et al in their study concluded that targeted training resulted in reduction of errors.<sup>[6]</sup> They studied the common causes of sample rejection and changed the training practices after analysing the problem areas. Results of the present study correlate with this study.

Sushma BJ, Shrikant C emphasized the effect of training on reducing errors in preanalytical phase.<sup>[7]</sup> They promoted ideal phlebotomy practices a prerequisite for lab efficiency. They were able to demonstrate reduction in errors by training. Analytical and post analytical phases have undergone major advances and errors in those phases have been drastically reduced because of automation and lab information systems.

Lee NY reported decrease in preanalytical errors after training and conducting questionnaire based comparison.<sup>[8]</sup> The study emphasized on efforts to identify and analyse pre analytical errors. Targeted training should be conducted based on the findings. Reduced errors shall translate into increased staff satisfaction and patient safety.

Study by Sawant SD, Patil AA et al S showed significant reduction in many preanalytical errors by programs that created awareness about the standard operating procedures.<sup>[9]</sup> Implementation of standard operating procedures and continuous educational training can reduce errors due to human factors.

Arslan FD, Karakoyun I et al also showed significant decrease in preanalytical errors incidence by training.<sup>[10]</sup> They devised a questionnaire and provided training to nursed and lab technicians. They recommended standardization of processes and regular training.

Al-Ghathithi H, Pathare A et al commented that non conforming samples waste time and resources of lab and are an obstacle to valid lab results.<sup>[11]</sup> Targeted educational training to nursing staff, resulted in a significant reduction in preanalytical errors.

Study conducted by Toshniwal P, Toshniwal S et al has recommended continuous training of medical and paramedical staff and also making them aware of preanalytical phase errors.<sup>[12]</sup> They were able to significantly reduce the numbers of errors by trainings

and creating awareness.

Li HY, Yang YC, Huang WF et al reported significant decrease in disqualification rate in preanalytical errors.<sup>[13]</sup> They used training to affect quality awareness of the concerned staff. They found it to be very effective in reducing the errors.

In the present study, errors were defined as per needs of the institute. Data thus collected was analysed and it was felt that there was scope for improvement. After studying the literature available at various platforms, it was decided to impart training to the staff involved in the process of sample collection. Data analysis in the post training period showed significant reduction in the number of errors.

## CONCLUSION

Errors in preanalytical phase are a burden on the resources and delay the diagnosis or treatment of the patients. Analytical and post analytical phases have been largely automated, thereby minimizing chances of errors. Preanalytical phase has the maximum human involvement, hence maximum chances of errors. Sample collection has many variables involved – different types of vacutainers, different sample quantities, a confusing draw order, different levels of staff with different levels of skill and knowledge, addition of new tests to the scope– and all add to potential for errors. Trainings to the staff involved in sample collection go a long way in reducing these errors. Trainings should be continuous and based on analysis of errors detected. Staff should be made aware about the magnitude and spectrum of non conformities in sample collection.

## ACKNOWLEDGEMENTS

None

## CONFLICT OF INTEREST/ FUNDING: None

## REFERENCES

1. Sushma BJ, Shrikant C. Study on “Pre-analytical Errors in a Clinical Biochemistry Laboratory”: The Hidden Flaws in Total Testing. *Biochem Anal Biochem*, 2019; 8(1): 1- 6.
2. Battu G S, Battu A S. Incidence of Pre-Analytical Phase Errors: A Retrospective Study in Biochemistry Lab of a Tertiary Care Hospital. *International Journal of Biomedical Research*, 2020; 11(09): e5511.
3. Green S F. The cost of poor blood specimen quality and errors in preanalytical processes. *Clin Biochem*, 2013; 46(13-14): 1175-9.
4. Battu G S, Battu A S, Sidhu S. Comparison of Incidence of Pre-analytical Phase Errors in OPD and IPD Samples in a Super- Specialty Hospital: A Retrospective Study. *International Journal of Advanced Research*, 2020; 8(11): 171-174.
5. Alavi N, Khan S H, Saadia A, Naeen T. Challenges in preanalytical phase of laboratory medicine: rate of

- blood sample nonconformity in a tertiary care hospital. *eJIFCC*, 2020; 3 (1): 21-27.
6. Chavan PD, Bhat VG, Poladia P, Tiwari MR, Naresh C. Reduction in sample rejections at the preanalytical phase – Impact of training in a tertiary care oncology center. *J Lab Physicians*, 2019; 11(3): 229-233.
  7. Sushma BJ, Shrikant C. Study on “Pre-analytical Errors in a Clinical Biochemistry Laboratory”: The Hidden Flaws in Total Testing. *Biochemistry & Analytical Biochemistry*, 2019; 8 (1): 1-6.
  8. Lee NY. Reduction of pre-analytical errors in the clinical laboratory at the University Hospital of Korea through quality improvement activities. *Clinical Biochemistry*, 2019; 70: 24-29.
  9. Sawant SD, Patil AA, Bansode AA, Varma S. Small Steps for a Big Change: Attention towards Preanalytical Error. *International Journal of Biochemistry Research & Review*, 2019; 28(1): 1-9.
  10. Arslan FD, Karakoyun I, Basok BI, Aksit MZ, Celik E, Dogan K, Duman C. The effects of education and training given to phlebotomists for reducing preanalytical errors. *J Med Biochem*, 2018; 37(2): 172-180.
  11. Al-Ghaithi H, Pathare A, Al-Mamari S, Villacrucis R, Fawaz N, Alkindi S. Impact of Educational Activities in Reducing Pre-Analytical Laboratory Errors. *Sultan Qaboos University Med J*, 2017; 17(3): 309-313.
  12. Toshniwal P, Toshniwal S, Shah RM. A retrospective six months study on pre-analytical errors occurring in OPD in a tertiary care hospital: “The first step for patient safety in clinical diagnostics and its impact.” *European Journal of Biomedical and Pharmaceutical Sciences*, 2016; 3(6): 637-641.
  13. Li HY, Yang YC, Huang WF, Li YF, Song P, Chen L, Lan Y. Reduction of preanalytical errors in laboratory by establishment and application of training system. *Journal of Evidence Based Medicine*, 2014; 7(4): 258-262.